30 December 2015

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Dear Ms White

Regulatory Impact Statement on Electricity Safety (Bushfire Mitigation) Regulations 2015

AusNet Services welcomes the opportunity to provide this submission in response to the Regulatory Impact Statement (RIS) on proposed amendments to the Electricity Safety (Bushfire Mitigation) Regulations 2015.

AusNet Services is committed to minimising the risk of bushfire and implementing the recommendations of the Victorian Bushfire Royal Commission. Our commitment is demonstrated by the significant investment we have made in bushfire and safety in the 2011-15 regulatory period (which exceeds $500 million) and our active involvement and investment in rapid earth fault current limiter (REFCL) trials. Consistent with this, AusNet Services supports the use of REFCLs to reduce bushfire risk.

However there are policy matters for the Victorian Government to consider which relate to ensuring the expected bush fire risk reduction benefits identified in the RIS are delivered, and that the costs of doing so are reasonably certain. Further, the RIS assessment of the expected reliability benefits from REFCLs is questionable when analysed in the context of AusNet Services' network. Together, these matters significantly impact the Government's assessment of the expected net benefits of the Regulations.

Left unaddressed, there is a risk that the proposed Regulations may fail to deliver the expected benefits in regards to their magnitude and timing, but also cost Victorians much more than the RIS estimates. The assertions of the RIS which AusNet Services explicitly questions are whether:

1. The proposed timeframe for installing REFCLs is optimal;
2. There is certainty around the costs associated with installing REFCLs; and
3. REFCLs will deliver reliability benefits.

AusNet Services strongly disagrees with these aspects of the RIS and, as explained below, considers it important to correct these points.

RIS assumption 1: The proposed timeframe for installing REFCLs is optimal

A major concern is that the RIS significantly understates the technological, operational and commercial challenges that exist in relation to the REFCL program. Using REFCL technology to reduce bushfire risk presents significant network changes and operational challenges to overcome. Utilising REFCL technology involves a fundamental shift in engineering practice which will take time to understand, implement and manage. Further, the

REFCL trials have highlighted the extent to which issues emerge as the technology is applied in different sections of the network.

The RIS also implies that AusNet Services is not committed to implementing REFCL technology in a timely manner[1]:

> *"Despite the capability of REFCLs to reduce the likelihood that polyphase powerlines will start bushfires, AusNet Services and Powercor have only committed to trial a couple of REFCLs each in their respective electricity distribution areas. Given their lack of experience with the new technology, and the risks associated with using unproven technology on a live network supplying customers, they are not prepared to commit to further installations until the trials have been successfully concluded."*

AusNet Services rejects the suggestion that there is a reluctance to commit to the installation of REFCLs to minimise bushfire risk. AusNet Services' approach reflects genuine concerns regarding the technical and operational risks in using REFCLs to mitigate bushfire risk, especially given the current reliance on a single REFCL manufacturer. Marxsen Consulting highlighted similar concerns regarding implementation risk in its 2014 report for the Department:

> *"…the wide-scale roll-out of REFCLs is likely to take at least a decade if the risks are to be properly managed."*[2]

AusNet Services' strong preference is to take a more practical approach to the early stages of the REFCL installation program, which will allow time to address the outstanding risks and embed learning. A less pressured installation program also provides an opportunity for improved technological solutions to emerge and for other manufacturers to enter the market. AusNet Services' view is that a more measured and considered rollout of the REFCL installation program will provide significant benefits, particularly in terms of lower costs and reduced operational risk.

As explained in the attached submission, the RIS underestimates the technical, operational and commercial risks associated with the implementation of REFCL technology. AusNet Services also notes that the RIS does not explicitly consider the issue of optimal timing, which is an unusual omission in a cost benefit assessment of this kind. An options analysis that examines alternative timings of the REFCL program is important, not least because it would highlight the loss of optionality in adopting the proposed timetable.

In the attached submission, AusNet Services has proposed a more practicable timetable for REFCL implementation. This amended program would achieve full delivery of the REFCLs recommended in the RIS by the end of 2024, as compared to the current program, which proposes completion by December 2022, but is more aggressive timing than envisaged by the 2014 Marxsen Consulting Report. Most importantly, AusNet Services' delivery program will provide the ability to fully maximise the technology's bushfire mitigation benefits and its integration with existing network systems, as well as greater opportunities to manage the network operation risks associated with a major technology implementation of this kind.

This is consistent with the Victorian Department of Treasury and Finance's Guidelines for the development of high value high risk investment projects in Victoria.[3] These guidelines set out that a critical stage for investment planning is the "Prove" stage which emphasises the need to confirm that the recommended project can achieve the benefits sought, and indicates the likely costs and risks to the State. The Guidelines also set out that before

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1 ACIL Allen, Regulatory Impact Statement, Bushfire Mitigation Regulations Amendment, 17 November 2015, page 31.

2 Marxsen Consulting, REFCL Trial: Ignition Tests, 4 August 2014, page 10.

3 DTF, http://www.dtf.vic.gov.au/Investment-Planning-and-Evaluation/Understanding-investment-planning-and-review/What-are-the-investment-lifecycle-and-high-value-high-risk-guidelines, accessed 23 December 2015

committing to an investment the decision-maker needs to be confident that, amongst other things, the solution can be delivered as planned (on time, within budget, quality etc).

It should be emphasised, however, that even AusNet Services amended timetable is not without significant risks, given the outstanding technical and commercial issues that remain.

AusNet Services recognises that the Victorian Government may maintain an accelerated REFCL installation program, despite the remaining technological, operational and commercial risks. In these circumstances, however, it is important to recognise the possible adverse consequences in terms of cost and performance outcomes and that it will be the Victorian Government's call to proceed despite these risks.

RIS assumption 2: Costs are relatively certain

The RIS broadly accepts the distributors' cost estimates of installing REFCLs, with the exception of the costs of replacing surge arrestors. However, the RIS does not recognise that these cost estimates are subject to significant uncertainty – not least because of the untested nature of the technology in a high bushfire risk setting, as explained above - and the current reliance on a single manufacturer.

The reliance on a small, sole supplier exacerbates the risk of cost overruns and delay, and the potential lack of technical support. The RIS does not acknowledge or address these uncertainties.

In Attachment A of this submission, AusNet Services explains how more detailed costing undertaken since the provision of initial cost estimates in early 2015 has provided firmer cost estimates which are approximately 30% higher than indicated in the RIS. Furthermore, these cost estimates do not include overheads, project management costs and interest during construction. It is important that the Department factors these updated cost estimates into its cost-benefit assessment.

RIS assumption 3: REFCLs will deliver reliability benefits.

The RIS assumes that the installation of REFCLs will deliver significant reliability benefits. However, this conclusion is based on the experience of New Zealand distribution businesses operating REFCLs in continuous compensation mode on systems that are fundamentally different in design.

The primary objective in operating REFCLs in continuous compensation mode is to deliver reliability improvements, not bushfire safety. In this mode of operation, conductors may remain energised at unsafe clearances if, or example, damage to an overhead line is caused by a fallen tree. As a consequence, the assumed reliability improvements in the RIS may be incompatible with the principal goal of bushfire risk mitigation.

It is important that estimated reliability improvements have regard to the distributor's particular circumstances, recognising that they may be materially different to other networks. In AusNet Services' case, approximately $44 million has been invested in Distributed Feeder Automation (DFA) schemes to improve reliability. This investment places AusNet Services at a different starting point in relation to reliability performance, and reduces the potential reliability benefits from installing REFCLs.

Furthermore, the required integration of DFA and REFCL technology on AusNet Services' network introduces an additional technical challenge which, if not properly addressed, could have a negative impact on reliability performance. We also note that the REFCL program will also require significant interruptions to customer supply – also negatively impacting on reliability – in order to undertake the required network balancing to ensure the REFCL technology operates as intended.

Given the issues noted above and the uncertainty regarding the potential impact of the program on reliability, it is inappropriate to assume any reliability benefits will be provided by

the REFCL program. The RIS analysis should therefore focus on the efficacy of the technology in meeting its primary goal, which is bushfire mitigation.

Who pays?

On a related matter, the RIS assumes that the costs of bushfire mitigation should be borne by the relevant distribution customers. This contrasts with statements in the RIS, which recognise that all Victorians benefit from bushfire reduction. It follows that the costs of bushfire mitigation measures should be shared across the beneficiaries – being all Victorians. The RIS approach imposes a disproportionate cost on AusNet Services' customers, especially those in low bushfire risk urban areas when similarly situated customers served by urban distributors avoid having to cross subsidise customers in high bushfire risk areas.

Further, the proposed Regulations place substantial commercial risk on AusNet Services' shareholders and customers. It is not appropriate that our shareholders and customers bear the financial risks of this government policy.

Concluding observations

The discussion set out above highlights a number of assumptions or assertions in the RIS that AusNet Services does not support. AusNet Services considers that if these positions are corrected – as they should be – the RIS would provide:

- A clearer articulation of the objectives and net benefits of the regulation.
- A more realistic assessment of the potential reliability benefits.
- A proper examination of the technical, operational and commercial risks associated with the REFCL installation program.
- An appropriate consideration of the uncertainty and risks regarding outturn costs.

In relation to the Government's proposed amendments to the Bushfire Regulations, an updated RIS would likely result in important changes to the existing proposal:

- a longer and differently profiled REFCL implementation program; and
- cost recovery through general taxation, rather than through electricity prices.

AusNet Services would be pleased to discuss the attached submission in further detail at your convenience. Please contact me on 03 9695 6090 or via email at alistair.parker@ausnetservices.com.au if you have any questions regarding this submission.

Yours sincerely,

Alistair Parker
General Manager Asset Management

1 INTRODUCTION

AusNet Services appreciates the opportunity to comment on the proposed amendments to the Electricity Safety (Bushfire Mitigation) Regulations 2013 and the supporting Regulatory Impact Statement (RIS).

The proposed recommendations are the culmination of significant work by Government and industry following the 67 recommendations made by the 2009 Victorian Bushfire Royal Commission, 8 of which relate to reducing the likelihood of power lines starting catastrophic bushfires.

The proposed regulations address the following VBRC recommendation:

> ***Recommendation 27: progressive replacement of 22kV and SWER powerlines***
>
> *The State amend the Regulations under Victoria's Electricity Safety Act 1998 and otherwise take such steps as may be required to give effect to the following:*
>
> - *the progressive replacement of all SWER (single-wire earth return) power lines in Victoria with aerial bundled cable, underground cabling or other technology that delivers greatly reduced bushfire risk. The replacement program should be completed in the areas of highest bushfire risk within 10 years and should continue in areas of lower bushfire risk as the lines reach the end of their engineering lives*
> - *The progressive replacement of all 22-kilovolt distribution feeders with aerial bundled cable, underground cabling or other technology that delivers greatly reduced bushfire risk as the feeders reach the end of their engineering lives. Priority should be given to distribution feeders in the areas of highest bushfire risk.*

The proposed amendments require the following network investments to be undertaken for the purpose of mitigating bushfire risk:

- installation of SWER Automatic Circuit Reclosers (ACRs);
- replacement of power lines with insulated cables in 'declared' areas; and
- installation of Rapid Earth Fault Current Limiter (REFCL) devices.

This submission is structured as follows:

- Section 2 provides a summary of the key points in this submission;
- Section 3 addresses the proposed regulations regarding power line replacements;
- Section 4 addresses a range of issues concerning the proposals relating to REFCLs;
- Section 5 presents AusNet Services' alternative REFCL installation timetable;
- Section 6 highlights the key issues relating to cost recovery; and
- Section 7 discusses the future design of the F factor scheme.

2 SUMMARY OF KEY POINTS

2.1 Installation of SWER ACRs

AusNet Services supports the installation of Single Wire Earth Return (SWER) Automatic Circuit Reclosers (ACRs). The regulations reflect an initiative that AusNet Services commenced in 2011. The company remains on schedule to complete the installation of ACRs on all of its SWER systems by 31 December 2015.

Completion of this program will be in accordance with the company's Electricity Safety Management Scheme (ESMS) that was accepted by Energy Safe Victoria (ESV). This initiative was included in AusNet Services' 2011-2015 Electricity Distribution Price Review (EDPR) submission, which the Australian Energy Regulator (AER) accepted as a regulatory obligation.

Accordingly, AusNet Services has no further comments regarding the implementation of these proposed regulations.

2.2 Power line replacement

AusNet Services agrees with the proposed regulations regarding replacement of power lines with insulated cables in 'declared' areas. However, there is a strong case for funding the proposed power line replacement initiative under a framework similar to the Government's Powerline Replacement Fund (PRF).

AusNet Services considers that the assumptions made in the RIS regarding the suitability of a new covered carbon core conductor, currently under trial, are overstated. The conductor is designed for sections of the network that enjoy low fault currents and light electrical load, which is not typical of approximately 70% of AusNet Services' declared network.

In addition, the RIS assumes that the cost of this new technology will be 50 per cent lower from 2020 onwards. However, there is no basis for this assumption especially given the current reliance on a single supplier.

2.3 Installation of REFCLs

AusNet Services agrees that REFCL technology offers the potential for reducing network related bushfire risk. However there are policy matters for the Victorian Government to consider which relate to ensuring the expected bush fire risk reduction benefits identified in the RIS are delivered, and that the costs of doing so are reasonably certain. The discussion in section 4 below casts significant doubt over the following implicit assertions or assumptions in the RIS:

- The proposed timeframe for installing REFCLs is optimal;
- A fast and high volume rollout of REFCLs will deliver the estimated benefits without the risk of cost overruns; and
- REFCLs will deliver reliability benefits.

The potential benefits of REFCL technology have been demonstrated in albeit limited REFCL trials at Frankston South (United Energy) and Kilmore South zone substations. The purpose of the yet to be commissioned Woori Yallock trial is to develop and understand the operation of REFCL technology on a much more complex rural network. A key aim is to deploy this technology in a way that minimises bushfire danger, whilst ensuring that customer reliability is maintained.

Importantly, these trials have led to the following conclusions:

- REFCL technology can reduce the risk of bushfire ignition on small, simplified networks under closely supervised control.
- There is only one supplier of REFCL technology suitable for bushfire mitigation, and the product offered by that supplier will require further development before it can be installed across the Victorian distribution network.
- There is considerable uncertainty regarding the operation of REFCLs within complex rural networks, which are naturally imbalanced in terms of electrical capacitance.
- The proposed mode of operation on non Total Fire Ban days introduces other safety risks, such as live conductors on ground or at low clearances.

AusNet Services considers that the RIS has focused on the positive outcome of bushfire reduction without fully considering the challenges posed by the findings noted above. In effect, the RIS has underestimated substantially the challenges identified by the trials. In addition, the RIS has not considered the particular challenges of using REFCL technology to deliver reliability benefits on AusNet Services' network, given the substantial reliability investment in relation to Distributed Feeder Automation (DFA) schemes and the integration challenges.

AusNet Services has reviewed the high level cost estimates it provided during the RIS development process, and concluded that these initial estimates were understated by at least 30 per cent. The factors that have led to this cost revision are described in Attachment A.

While the technical and cost concerns identified by the trials should not affect the Government's decision to introduce regulations to install REFCLs, there are important implications for the optimal timing of the program. AusNet Services is particularly concerned that the current timetable for RECFL implementation allows very limited time for understanding and managing the technological, operational and commercial risks.

In light of these considerations, AusNet Services has developed an alternative REFCL installation program. Our alternative proposal is set out in section 5, while section 4 expands on the concerns outlined above.

2.4 Cost recovery arrangements

AusNet Services does not accept the assumption that distribution customers should pay for the costs of bushfire risk mitigation measures. From a public policy perspective, there is a strong case for funding this public good via the taxation system, rather than through electricity prices. Our stakeholder consultation process has indicated strong support for this approach

We discuss this issue further in section 6.

2.5 F-factor and the need for regulations

The RIS comments that due to market and regulatory failure, distributors have weak incentives to mitigate bushfire risk. It also states that the Victorian Government is reviewing the F-factor incentive scheme as it is considered a 'weak' incentive mechanism. AusNet Services would welcome the opportunity to engage in further dialogue with the Department and Minister regarding the proposed changes to the F-factor scheme. We discuss this issue further in section 7.

3 POWER LINE REPLACEMENT

3.1 Background

The RIS recommends that regulations be amended to require power lines in 'declared areas' to be insulated as and when they are replaced. This requires power lines in the most dangerous areas of the state to be put underground or insulated on replacement. The trigger for line replacement will be where four or more consecutive spans require replacement.

AusNet Services agrees with the proposed regulations regarding replacement of power lines with insulated cables in declared areas. The framework for specifying declared areas and the respective network construction standards is consistent with submissions made by the distribution businesses in support of the Government's $200 million Powerline Replacement Fund (PRF).

The replacement of power lines in the highest bushfire risk areas provides benefits to the broader community within Victoria, not just AusNet Services' customers. Accordingly, there is a strong case for funding the proposed power line replacement initiatives under a framework similar to the Government's PRF. Importantly, this would ensure that the costs of power line replacement are borne by the Victorian community as a whole.

In addition, AusNet Services is concerned that assumptions made in the RIS regarding the cost and performance of new covered carbon core conductors may be overly optimistic. Specifically:

- The effectiveness of new covered carbon core conductors is currently under trial. Accordingly, there is uncertainty regarding the extent of suitability of the new conductors, especially in areas of high fault current and load.
- The RIS assumes that line replacement costs will reduce by approximately 50% after 2020 with the introduction of new carbon core covered conductors. Whilst it is reasonable to expect some reduction in the cost of this new conductor in the future, AusNet Services considers the assumption of a 50% reduction after 2020 is arbitrary and may lead to a material underestimation of the costs of the power line replacement regulations.

Further details on these matters are set out below.

3.2 Effectiveness of Covered Carbon Core Conductor

AusNet Services considers that the assumptions in the RIS regarding the suitability of a new 'covered carbon core conductor' are likely to be overly optimistic, for the reasons set out below.

The conductor is designed for sections of the network exposed to low fault currents and light electrical load. Such operating conditions contrast with those that prevail in approximately 70% of AusNet Services' network in declared areas. Discussions with the supplier have explored ways of increasing conductor ratings. However, at this stage it is uncertain whether the technology will provide a feasible alternative to current covered cable construction methods in high load / high fault current situations.

As already noted, a trial of the conductor is currently underway in south west rural Victoria in Powercor's distribution area. One of the purposes of the trial is to gain an understanding of the conductor's failure modes, and how it may prevent or cause bushfires. The tests performed at Kilmore South have shown how a broken covered conductor in contact with the ground has the potential of starting a fire.

By way of background, when a bare wire conductor falls to ground the escape of electrical energy is generally dissipated to ground over a length of conductor, thereby reducing the amount of energy intensity at any particular point. However, failure of the covered carbon core conductor has the potential to expose the bare conductor contact to ground at a single point. This would concentrate the escape of electrical energy to higher intensity and increase the probability of fire ignition. Whilst a similar failure mode is possible with conventional insulated and covered cables, the design and construction of these existing lines includes a catenary cable that protects it from mechanical failure.

AusNet Services will continue to work with the industry and the conductor supplier to understand the performance of covered carbon core conductor in SWER and polyphase networks, under various environmental conditions, and under different failure modes. This will enable the industry to identify the most cost effective means of reducing bushfire risk through power line replacement, which may include the widespread use of covered carbon core conductor.

3.3 Cost of Covered Carbon Core Conductor

At present, the cost of the supplier's product is marginally lower than some of the least cost insulated and covered cable technologies. AusNet Services considers that if covered carbon core conductors were to be adopted by the industry as a standard, it would be reasonable to expect a decrease in the conductor price.

Currently, however, this particular conductor is only available from a single supplier. This consideration points to the need for caution in assuming price reductions that may accompany increases in future sales volumes of this product. In this context, as there is no basis to an assumption of a 50% reduction in costs after 2020, making this assumption appears optimistic and may, therefore, lead to under-estimation of the cost of the proposed power line replacement regulation.

4 REFCL INSTALLATION

4.1 Background

REFCL technology is able to detect a fault current quickly when wire-to-earth power line faults occur. The technology was developed for underground works and trials are currently determining its effectiveness for bushfire mitigation in the Victorian rural electricity distribution network.

It should be noted that utilising current REFCL technology that complies with the performance standard in the draft regulations involves a fundamental (or paradigm) shift in network earthing and protection philosophy. Currently AusNet Services utilises either a solidly earthed or resistive earthed systems whilst utilisation of current REFCL technology requires a resonant earthed system. Such a fundamental shift in engineering practice will take time to understand, implement and manage.

The data and experience gained through recent trials have greatly assisted the industry in developing an understanding of the capabilities of REFCL technology and the challenges in modifying current distribution networks to achieve the benefits of bushfire risk reduction.

Based on the results of the completed trials to date, AusNet Services agrees that REFCL technology offers a means for reducing network related bushfire risk. However, the implementation of this technology to achieve this objective is far from straightforward or certain. For example, approximately 80% of the required expenditure for installing REFCLs is not for the REFCL itself but to undertake consequential network expenditure beyond the zone substation.

While AusNet Services supports the development and installation of REFCL technology, it is important to recognise the associated uncertainties and risks.

The following sections focus on the following sources of risk and uncertainty:

- Technology;
- Reliability;
- Cost assumptions and risks, including sole supplier risk; and
- Installation timetable.

As explained below, a number of these issues are interrelated. For example, the technical complexities in developing a workable solution exacerbate the potential for cost overruns and program delays. Reliance on a sole supplier also heightens technology, cost and delivery concerns.

4.2 REFCL Technology Risks

For many years, REFCL technology has been used predominantly in Europe on three phase networks for reliability and asset protection purposes, but not bushfire mitigation. A fundamental requirement for effective operation of REFCLs is the maintenance of capacitive balance of the network, a feature that is somewhat easier in three phase networks. In the absence of balancing, the REFCL technology will not operate as intended.

The rural overhead networks built by the former State Electricity Commission Victoria (SECV) for electrification of the state utilised a cost effective design to address small load centres, distributed across large geographical areas. This approach resulted in a 22 kV distribution network, consisting of a mixture of three phase, single phase (two conductors) and SWER networks that, by design, have significant levels of capacitive imbalance.

A further relevant aspect of the design of distribution networks in Victoria is that electrical plant design specifications are for network operating voltages of 12.7 kV phase to ground. A feature of the REFCL technology is that when it operates to clear (neutralise) a faulted phase, the voltages on the remaining healthy phases increase to approximately 22kV. This large increase in voltage introduces the risk of electrical plant and equipment failure due to operating voltages being above their design limits. Replacement of plant and equipment to meet increased operating voltages under REFCL control is referred to as 'line hardening'.

Whilst REFCL operating modes pose technical challenges, AusNet Services considers that it may be possible to address these issues without requiring overhauling the existing network to make it all three phase and replacement of all plant and equipment. In fact, this assumption was reflected in our Electrical Safety Management Scheme (ESMS)[4] and the REFCL installation at Woori Yallock (WYK) zone substation (ZSS).

The purpose of the WYK REFCL project is to:

- Design and construct a REFCL that will operate on a complex rural distribution network in high fire loss consequence areas without deterioration in customer supply reliability; and
- Confirm the capability of the REFCL to reduce bushfire risk when installed on complex networks supplying high fire loss consequence areas. More specifically, the aim is to confirm that REFCLs reduce or eliminate fault current (energy) delivered to ground so that it is below limits that may result in fire ignition.

A second REFCL was subsequently constructed at Kilmore South (KMS), with a small 43 km section of rural network connected. The objective of this trial was to test the comparative performance of a range of REFCL technology configurations to identify optimal fault detection and suppression capability on a live network.

Trials undertaken at KMS and network balancing works being undertaken at WYK indicate the following issues.

Line hardening

As already noted, 'line hardening' is the process of replacing network plant and equipment not rated for the elevated voltages that REFCLs create when compensating for a fault on the network.

In this regard, the replacement of Lightning Arresters (LAs)[5], also known as surge arrestors, is a significant cost for the REFCL program. Whilst the sensitivity analysis undertaken within the RIS indicates a positive benefit assuming full replacement of LAs on an ongoing basis, it has suggested replacement of only 33% of LAs as an option. AusNet Services does not agree with the proposed option for replacing only 33% of LAs, for the following reasons.

- Allowing existing LAs to remain on a network operating at REFCL voltages for which they are under-rated can result in explosive failure, which is a known source of fire ignition. Such an outcome would undermine the purpose of installing REFCLs, which is to reduce the risk of bushfire.
- Assuming the adoption of the 33% LA replacement option proposed by ACIL Allen, a prudent operator would disconnect the remaining 67% of LAs to prevent an increased bushfire risk. The resulting labour costs would be similar, but leaves only a third of the network protected by LAs.

[4] Section 4.7.3 of AMS 20-13 Enhanced Network Safety plan, Issue 9, 14 June 2012.

[5] Lightning Arrestors are also known as Surge Arrestors or Surge Diverters.

- The option of limiting the number of LAs to 33% ignores their original purpose, which is to protect the network from lightning strikes, given the prevalence of lightning strikes in Victoria.

Network Balancing Risk

The installation of REFCLs on the existing network requires the establishment of cost effective methods to establish and maintain network capacitive balance. As already noted, network balance is essential if the REFCL technology is to operate as intended. As switching takes place immediately after a fault, capacitive balance is required in all possible network configurations for the REFCL to operate correctly.

The REFCL trial at Woori Yallock zone substation has highlighted the extensive work required to achieve network balance, including:

- extending the three phase network to provide greater flexibility to achieve balancing of feeders;
- the development of purpose designed and built low voltage capacitor banks; and
- transpositions were completed.

The network is continually subject to asset augmentation, replacement and operational switching, which creates challenges for network balancing.

It is noted that the draft regulations set out a standard for fault current of less than 0.5 amps. In order to achieve this with current REFCL technology the network needs to be capacitively balanced to less than 0.1 amps in the neutral of the zone substation transformer(s) which even on the small KMS test circuit was difficult to achieve. Maintaining network balancing within these limits is expected to be difficult and labour intensive. This example illustrates the importance of conducting trials. AusNet Services is currently developing technology and knowledge to achieve the required balancing cost effectively.

REFCL Operating Risk

Operating modes determine the response of REFCLs to network faults. As already noted, historically REFCLs have operated on predominantly underground networks.

The typical operating mode for three phase underground networks is for the REFCL to operate (compensate) for extended periods of time until the fault is located and isolated. This mode of operation delivers benefits of improved customer reliability had a REFCL not operated. The benefit of an underground network is that faults remain in an environment whereby potential harm to the public is minimal.

In comparison, the continuous compensation on an overhead network presents potential safety hazards to the public. Such hazards may arise from the operation of a REFCL in continuous compensation mode. This can occur when a faulted phase does not guarantee that the healthy phases - then operating at elevated voltages - remain at safe clearances. It is possible that the cause of the fault (such as a fallen tree) may have also dislodged one or more of the other phases that remain energised. This scenario is supported by the experience of New Zealand distributors operating REFCLs on overhead networks.

AusNet Services needs time to develop a better understanding of the range of hazards and options for mitigating those hazards associated with REFCL continuous compensation on an overhead network. Until that time, AusNet Services proposes that the operating modes be for short duration compensation before reverting to existing network protection schemes.

REFCL Integration Risk with Distributed Feeder Automation (DFA)

AusNet Services has invested approximately $44 million over recent years in DFA schemes. These schemes are designed to detect faults on a distribution network and automatically initiate network switching. Switching isolates the faulted section and thereby maintains

supply to the majority of customers. This program has already delivered significant reliability improvements to customers. However, these benefits may be eroded if REFCL soft fault confirmation technology is not developed and integrated into the sole supplier's package.

Planned and successful integration of REFCL installation with existing DFA schemes is essential for AusNet Services to maintain and protect its investment in improved customer reliability, fault location and DFA functions. Further, it would ensure $44 million of sunk capital investment will not be wasted. This planning and integration requirement also has implications for the REFCL installation timetable, which is discussed in sections 4.5 and section 5 of this submission

4.3 REFCL Impact on Network Reliability

The RIS anticipates significant reliability benefits arising from the REFCL installation program. However, the assumed benefits are principally based on experience in other countries, such as New Zealand, where REFCLs are not operated to reduce bushfire risk. Operating REFCLs in continuous compensation mode is not acceptable from a bushfire mitigation perspective.

Contrary to delivering reliability improvements, the REFCL installation program will cause significant interruptions to customer supply, in the short term. These interruptions will be required to undertake network balancing, which requires disconnection and reconfiguration of the network at points along the entire length of the affected power lines. In addition, the requirement to manage these interruptions will also have implications for the achievability of the proposed installation program.

The primary objective of the REFCL trials has been to assess and forecast the reduction in bushfire risk. Given the uncertainty regarding the potential impact of the REFCL for bushfire mitigation purposes on reliability, it is more appropriate to focus the RIS analysis on the efficacy of the technology in meeting its primary goal. On this basis, it is inappropriate to assume any reliability benefits arising from the REFCL program.

4.4 REFCL Cost Assumptions and Risks

AusNet Services is concerned that the RIS does not give sufficient consideration to the cost uncertainty of delivering the REFCL program and the risk of significant cost overruns. As explained below, there are 5 sources of cost uncertainty and risk:

- REFCL device installation;
- line hardening;
- network balancing; and
- integration with 'business as usual' activities;
- sole supplier risk

Each of these cost elements is examined below.

Cost of REFCL device installation

The RIS has not taken into account that some of the larger zone substations will require more than one REFCL device to be installed. Nor has the RIS accounted for the risk associated with a sole supplier of the technology increasing prices, especially if demand is effectively guaranteed by a regulatory obligation.

Cost of line hardening for REFCL Installation

Line hardening unit costs and volumes are also reasonably well understood. However there is a very significant difference in assumptions regarding the proportion of lightning arrestors

ACIL Allen proposes be replaced (33%) in the RIS compared to the distribution businesses' position (100%).

Cost of network balancing for REFCL Installation

The cost of network balancing to accommodate REFCL installation is not well understood. This is because each network supplied from a zone substation is unique and requires detailed engineering analysis to determine the most cost effective means of achieving and maintaining the required level of network balancing.

Network balancing thus represents a higher level of cost estimating risk, relative to the other elements. This is compounded by the fact that this cost risk is being extrapolated across the other zone substation networks. It is noted that this risk is slowly reducing as AusNet Services' experience with REFCL technology increases through the 'learning by doing' approach.

Cost of REFCL integration with BAU activities

An overarching principle for containing costs will be the integration of REFCL works with business as usual (BAU) activities. Experience indicates that early or premature commitment to large investment programs involving new technology and constrained timeframes leads to a high risk of:

- significant cost overruns; and
- failure to meet the required project objectives.

Adequate time must therefore be allowed to test and plan the roll out of new technology such as REFCLs.

REFCL sole supplier risk

A European manufacturer is currently the sole supplier of the only available REFCL device capable of meeting the proposed regulatory specifications. Following conclusion of the Kilmore Zone Substation Test Program in October 2015, the industry prepared a specification to facilitate the integrated installation and operation of the REFCL device within existing distribution protection and control systems.

The manufacturer is reviewing these specifications and negotiations are continuing to arrive at a mutually acceptable outcome. Until these negotiations are concluded there is a significant risk that the costs of securing the required volume of REFCL devices will be substantially higher than expected. The small scale nature of the sole supplier adds to the risk of these negotiations being protracted in time and possibly inconclusive.

4.5 REFCL Implementation Timetable

At present, there is no REFCL device operating on a rural network to the proposed bushfire performance standards. The small scale trials, which were completed in October 2015, continued to provide important insights and led to reappraisal of the operating assumptions and the proposed REFCL design. Accordingly, there is no certainty that all potential issues have been identified.

AusNet Services expects that there is an on-going need to address potential issues as the industry embarks upon commissioning and operating REFCL technology in a high bushfire risk setting. Inevitably, additional time will be required to resolve issues as they arise. For example, in relation to network balancing, bespoke engineering solutions are required for individual line segments. A combination of desk top engineering studies and extensive field measurement will be required to develop these solutions.

In addition to these challenges, the sole supplier is currently in the process of reviewing specifications developed by AusNet Services and Powercor. This review will allow the

technology that was trialled under laboratory type conditions to be installed and integrated with current network protection and control systems. At this time, acceptance by the supplier of the required specifications is yet to be achieved. The capacity of the supplier to meet the increased demand for REFCL units is an additional source of uncertainty.

For the reasons set out above, AusNet Services has significant concern over the proposed REFCL installation timetable. While the proposed timetable is aimed at achieving bushfire mitigation more quickly, it has significant potential to result in higher costs and unanticipated outcomes.

5 AN ALTERNATIVE REFCL PROGRAM

The RIS proposes an ambitious timetable to install REFCLs at 45 zone substations (ZSSs) across the state. AusNet Services is responsible for 22 of these installations.

The 45 ZSSs comprise 24 per cent of the State's total ZSSs, but are expected to provide 90 per cent of the potential bushfire risk reduction from REFCLs. Furthermore, the most critical 11 ZSSs are expected to provide 50 per cent of the benefit. Table 11 from the RIS (reproduced below) summarises the relationship between the number of REFCL installations and the attributable benefit in terms of risk reduction[6].

Table 11 **Potential bushfire risk reduction associated with the installation of REFCLs**

Number of ZSSs with REFCLs installed	Proportion of the total bushfire risk reduction that is attributable to REFCLs
11	50%
30	80%
45	90%
93	100%
189	100%

The implementation plan in the RIS is described as follows[7]:

> '*Fifteen REFCLs will need to be installed by 2018, a further 17 REFCLs will need to be installed by 2020 with the balance (13) installed by 1 January 2023.'*

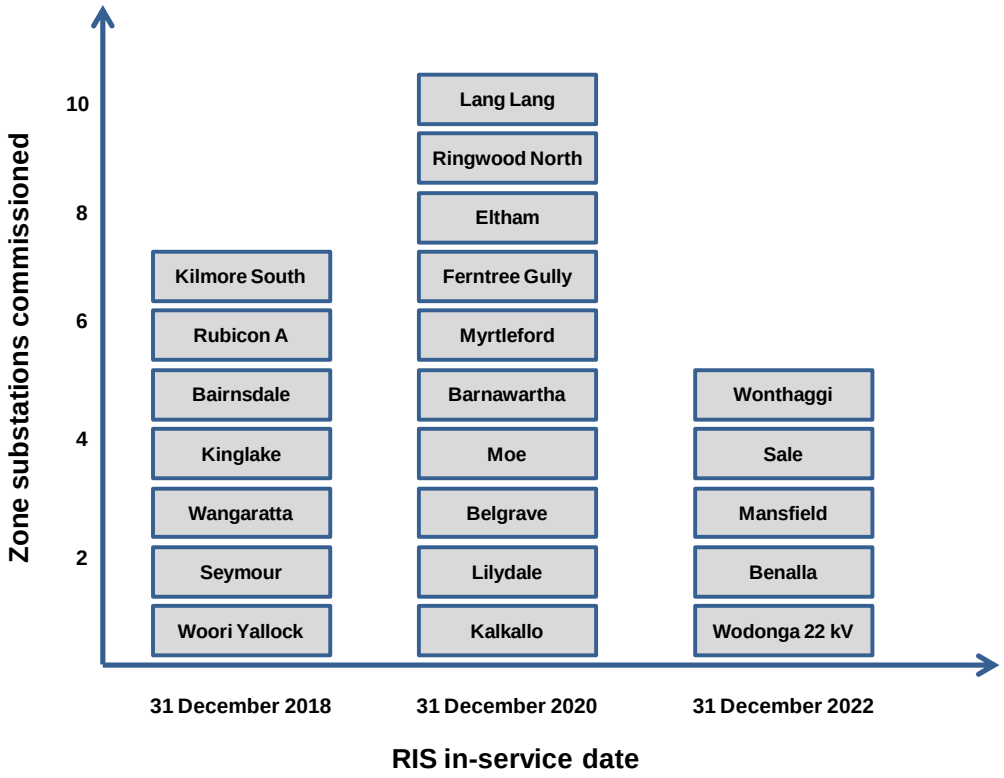
Based on Table 11, the proposal to install 15 REFCLs by 2018 will deliver approximately 60 per cent of the potential bushfire reduction from REFCL installation. This is a rapid deployment, and as noted in section 4, one that is not without its risks.

Under the proposed installation program in the draft regulation, the likely timing of REFCL installations on AusNet Services' network is shown below.

6 ACIL Allen, Regulatory Impact Statement, Bushfire Mitigation Regulations Amendment, 17 November 2015, page 52.

7 Ibid, page 110.

Figure 1: Likely timing of REFCL installation under the proposed regulation



As already explained in section 4, there are technological, operational and commercial risks associated with the application of REFCL technology to reduce bushfire risk. The scope for effective management of these risks declines as the pace of RECFL installation increases.

The RIS does not appear to have considered this trade-off in its cost benefit analysis. As a consequence, the proposed implementation may appear to minimise bushfire risk, but it also exposes the industry and its customers to the risk that the REFCL implementation will prove to be more expensive and/or less effective than would otherwise be the case.

The challenges in the effective implementation of REFCL technology have been highlighted by Marxsen Consulting in its report for the Department. As set out below, the issues raised by Marxsen are consistent with the concerns expressed in this submission[8]:

> *"For Victoria's network owners to adopt REFCL technology, they must address a number of cultural and technical challenges. Wide-scale roll-out of REFCLs is likely to take at least a decade if the risks posed by these challenges are to be properly managed. Some of the challenges are:*
>
> 1. ***Learn by doing – culture change for network owners and suppliers:*** *The thinking patterns among engineering and operations staff required to get full value from REFCL technology are profoundly different from those that are prevalent today. Suppliers also face major challenges in understanding the priority of fire risk goals in Victoria and the implications for their products.*
> 2. ***Harden networks to reduce risk of cross-country faults:*** *Vulnerabilities to the over-voltages created by REFCL responses to earth faults must be identified and addressed so cross country faults do not disrupt customer supply and start fires.*

[8] Marxsen Consulting, REFCL Trial: Ignition Tests, 4 August 2014, page 10.

3. ***Upgrade networks to REFCL-compatible equipment:*** *Many items of network equipment and network protection systems do not work with REFCLs and they must be upgraded or replaced to become REFCL-compatible.*

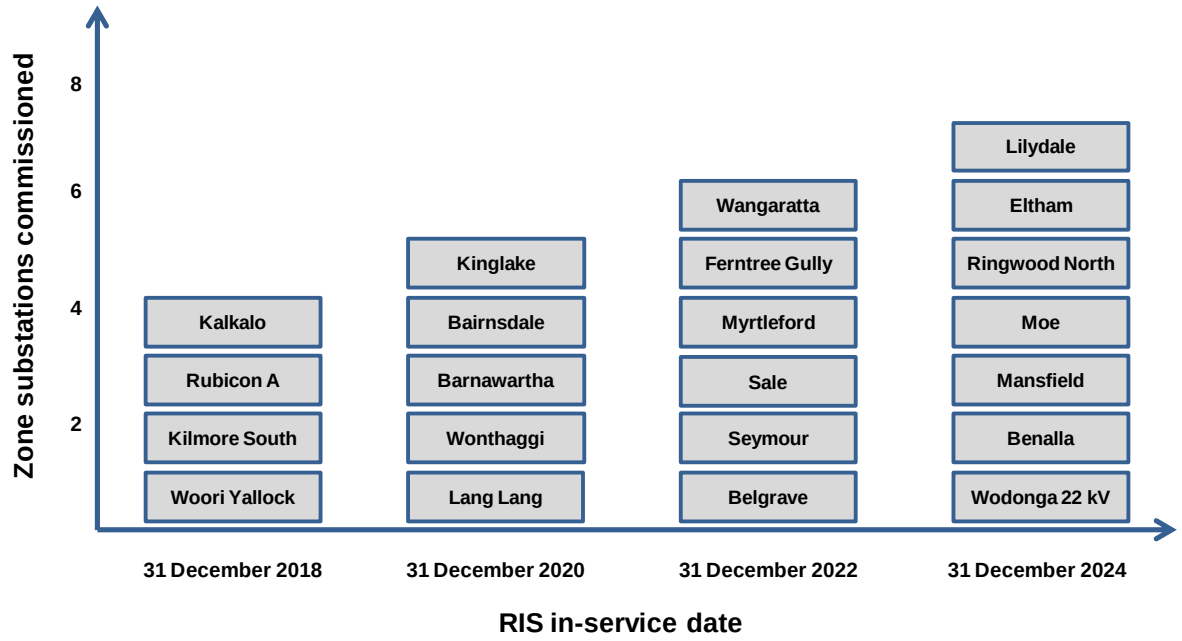
4. ***Minimise network imbalance:*** *Future REFCL products may be more tolerant of network imbalance (different capacitance to earth from each of the three phases). However, today's products are not, and network owners deploying REFCLs must act to minimise imbalance to achieve minimum fire risk.*

5. ***Be Able to Identify Future Fault locations:*** *With a REFCL in service many faults draw so little current they leave no evidence of their presence, i.e. they are hard to find. This is a complex challenge and new products are emerging to address it [i.e. time is needed for these products to emerge]."*

AusNet Services considers that the evidence from Marxsen strongly suggests that a slower pace of implementation will co-optimise the bushfire risks and the technological, operational and commercial risks associated with the new application of REFCL technology.

In view of these considerations, AusNet Services has developed an alternative REFCL program installation, as set out below. It should be noted, however, that even this program is an optimistic proposal in view of the REFCL risks noted above and in section 4.

Figure 2: AusNet Services' proposed alternative timing for REFCL installations



The table below compares the installation profile proposed by AusNet Services with that implied by the proposed regulation.

Table 1: Alternative REFCL installation profiles

		31 Dec 2018	31 Dec 2020	31 Dec 2022	31 Dec 2024
REFCLs commissioned this year	AusNet Services' proposal	4	5	6	7
	Proposed regulation	7	10	5	0
Total REFCLs in service	AusNet Services' proposal	4	9	15	22
	Proposed regulation	7	17	22	22

AusNet Services' proposed program achieves full delivery of all the REFCLs recommended in the RIS by the end of 2024, as compared to the RIS proposed program completion of December 2022.

Most importantly, AusNet Services' delivery program will:

- provide improved opportunity to better understand and secure the potential benefits from the technology;
- facilitate more effective management of the operational risks associated with the implementation of a major technology;
- enable integration with planned Zone Substation projects; and
- improve the overall outcome for customers in terms of cost and performance.

6 COST RECOVERY ARRANGEMENTS

AusNet Services' current substantial investment in reducing bushfire ignition risk (over $500 million) already imposes significant costs on AusNet Services' customers. In contrast, the benefits from this expenditure are enjoyed by the wider Victorian community. The RIS commented on this issue as follows:[9]

> "*The benefits from improved powerline bushfire safety have the characteristics of a public good. That is, the benefits are non-rival (one person benefiting from improved safety does not decrease anyone else's benefit) and non-excludable (it is not possible to prevent someone from benefiting from the improvement in safety). This means that the benefits of improved bushfire safety are not limited to a particular electricity distributor and its customers.*"

The RIS also commented on the VBRC estimate of the major economic costs that were incurred as a result of Victoria's January-February 2009 bushfires, which were also widely dispersed:[10]

> "*Of these costs:*
>
> - *approximately 32 per cent of the costs will be incurred by those in the bushfire affected areas*
> - *approximately 68 per cent of the costs will be incurred by Victorians more broadly*
> - *a very small proportion (less than 2 per cent) of the costs will be incurred by the electricity distributors themselves.*"

It follows from the above observations that the costs of bushfire mitigation measures should be met by the wider Victorian community, rather than by AusNet Services' customers. The validity of this approach is already acknowledged through the tax payer funded government Powerline Relocation Fund. Furthermore, our customer engagement activities carried out as part of the current price review process indicate strong support for a taxpayer funding approach.

The alternative approach of recovering costs through electricity distribution tariffs is particularly inequitable for our urban customers. These customers should not be treated any differently to other residents of urban areas in Victoria.

AusNet Services therefore recommends a state fund similar to the Powerline Relocation Fund is created for the REFCL program and any further bushfire mitigation measures which benefit the wider state.

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9 ACIL Allen, Regulatory Impact Statement, Bushfire Mitigation Regulations Amendment, 17 November 2015, page 39.

10 Ibid, page 40.

7 INCENTIVES TO ADDRESS BUSHFIRE RISK

7.1 Incentives to address bushfire risk

The RIS states that the objectives of the proposed regulation are to address market failures and to reduce the risk to the public of power lines starting bushfires[11]. In relation to market failure, the RIS comments as follows[12]:

> *"In the absence of the market and regulatory failures discussed in this section, and the misalignment of risks between the electricity distributors and the Government, as discussed in section 3.4, the electricity distributors would be more likely to:*
>
> - *install REFCLs in the highest consequence bushfire risk areas on a more timely basis to reduce the likelihood that polyphase powerlines start bushfires*
> - *install new generation SWER ACRs to reduce the likelihood that SWER powerlines start bushfires*
> - *put powerlines in the most dangerous areas of the state underground or insulate the conductors.*
>
> *However, a number of market and regulatory failures affect the likelihood that electricity distributors will take these actions to reduce the likelihood that powerlines start bushfires. The main market and regulatory failures are the public good nature of the benefits of reducing bushfire risks; and the way distributors, as natural monopolies, are regulated."*

The RIS draws the following conclusion[13]:

> *"Because the full benefits of improving powerline bushfire safety do not accrue directly to the electricity distributors, the incentives for improving powerline bushfire safety are weak. In the absence of additional incentives for making this investment, distributors may not invest to the level considered appropriate by the Government to improve powerline bushfire safety."*

AusNet Services does not accept the commentary in the RIS regarding market and regulatory failure, or its conclusion that distributors have weak incentives to mitigate bushfire risk.

Our commitment to safety is best illustrated by the significant expenditure on bushfire and safety related expenditure in the 2011-15 regulatory period (which totals $500 million), and our active involvement and investment in the REFCL trials. In October 2012, the AER approved an expenditure allowance of $12.8 million for the Woori Yallock REFCL trial, while no additional allowance was sought in relation to Kilmore South REFCL.

As explained in AusNet Services' 2016-2020 Regulatory Proposal, the increases in safety-related expenditure in the current regulatory period are delivering improved outcomes for the community. Both the number of incidents with the potential to cause a fire and the number of actual fire starts caused by AusNet Services' assets has fallen since 2009. These

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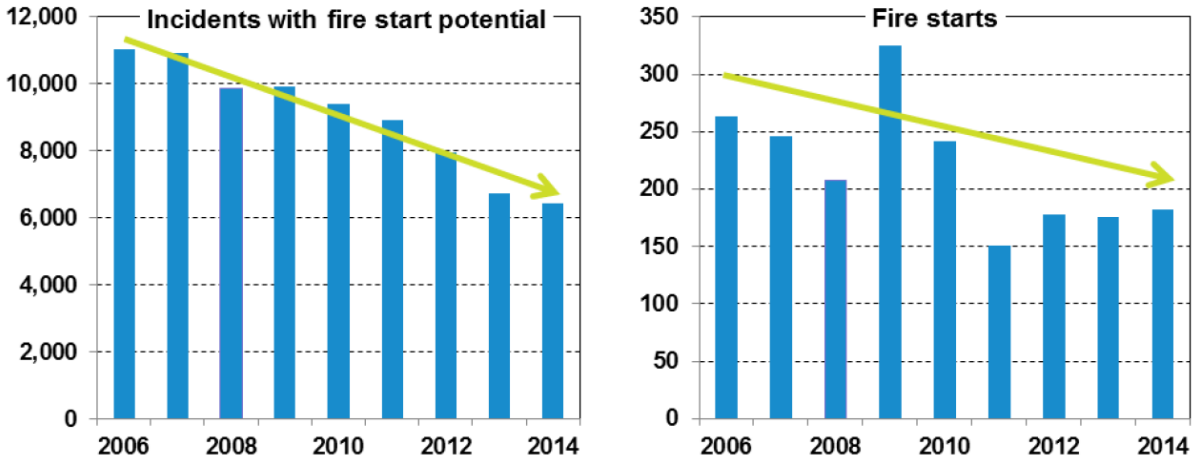
11 ACIL Allen, Regulatory Impact Statement, Bushfire Mitigation Regulations Amendment, 17 November 2015, page 33.

12 Ibid, page 39.

13 Ibid, page 40.

significant improvements are illustrated in **Error! Reference source not found.** below, which is reproduced from AusNet Services' Regulatory Proposal[14].

Figure 3: Fire risk indicators, all causes



The improvements achieved in relation to fire starts is consistent with AusNet Services' corporate values to never compromise on safety, and to genuinely care for the wellbeing of people. The prudent and efficient management of bushfire risk is an integral component of our safety commitment. AusNet Services is concerned that the commentary in the RIS does not reflect the tangible bushfire safety improvements delivered to date.

In addition to the demonstrable improvements in bushfire safety, the RIS also gives insufficient regard to the legislative obligations on all Victorian distributors to minimise bushfire risk. In particular, the Electricity Safety Act 1998 imposes a general duty on certain owners of electrical infrastructure, including in hazardous bushfire risk areas, to minimise the risk of bushfire ignition due to failures of this infrastructure. The Act also requires these parties to prepare, and have accepted by Energy Safe Victoria (ESV), Bushfire Mitigation Plans, which set out the policies, strategies and other actions that they will take in order to comply with this general duty.

Given the magnitude and seriousness of these legislative requirements, the strength of any financial incentive to minimise bushfire risk is a lower order issue. The regulatory and legislative framework provides a robust mechanism to ensure that measures are taken by the owners of electricity infrastructure to minimise bushfire risk from their assets. As illustrated above, there is tangible evidence of AusNet Services' safety commitment which conflicts with the sentiments expressed in the RIS.

7.2 F-Factor

The RIS states that the Victorian Government is reviewing the F-factor financial incentive scheme as it is considered a 'weak' incentive mechanism. Recent discussions with Departmental staff have confirmed this, and it is expected the new scheme, currently being considered by the Minister, will commence on 1 July 2016.

An important objective of the F-factor scheme is to gather better information across Victorian distribution businesses on the causal factors and environmental conditions that lead to network related fire incidents. This information facilitates a better understanding of the varying levels of risks associated with network incidents.

[14] AusNet Services, Electricity Distribution Price Review 2016-20, Regulatory Proposal, Figure 7-28, page 139.

Understanding the varying levels of risk and the network augmentation or operational costs involved in addressing those risks is fundamental to modifying an incentive scheme that seeks to incentivise distribution businesses to cost effectively reduce bushfire risk. However, the Government has not sought the views and experience of the distribution businesses in its current review of the F-Factor to address network risks.

AusNet Services considers it would be prudent for Government to consult with the distribution businesses prior to implementing changes to the F-factor scheme, to ensure that any new F-factor scheme is sound, provides incentives that drive the desired customer outcomes, and complements other investment incentive mechanisms.

Attachment A: Updated cost estimates for the installation of REFCLs

The following factors have led AusNet Services to revise its previous cost estimates upwards:

- Experience at the trial at Woori Yallock ZSS has shown that the third phase installation is more expensive than previously estimated.
- ZSS at 10 sites (50%) require multiple off Ground Fault Neutralisers rather than 1, due to the size of the network and its effect on damping.
- The regional location of 14 zone substations (66%) will lead to a living away from home allowance being incurred during the third phase of installation.
- Surge arrestor installation is more expensive than previously estimated due to need to install fire rated surge arrestors with a Uc rating of 24kV for pole top substations and the protection of underground cables and gas switches/ACRs.

In aggregate, these factors indicate that the costs of REFCL program are approximately 30% higher than indicated in the RIS. Furthermore, it should also be noted that the cost estimates in the RIS do not include overheads, project management costs or interest during construction.

AusNet Services would be pleased to discuss its revised cost estimates with the Department.